

### Filter unit for filter-cigarettes and filter cigarettes

The present invention relates to a filter unit for reducing the tar and nicotine content of the smoke of cigarettes containing a tobacco body and a filter tip.

5 Furthermore the invention relates to cigarettes containing filter unit.

The tobacco industry makes efforts all over the world to sell tobacco products with the possibly lowest tar and nicotine content with preserving, at the same time, their delight value. In the USA and in Europe, there are statutory 10 regulations putting a ban from 2004, on cigarette products with tar content exceeding 10 mg.

The tobacco raw material is grown in improved breeding in order to obtain a plant with increased aroma, resin and sugar content at the lowest harmful 15 nitrogen compound content and, at the same time, plants with finer leaves. After harvesting the leaves, the tobacco is fermented, in which process the tobacco heats up, its weight decreases and changes caused by enzymes and bacteria occur. The fermented tobacco is processed to tobacco products: cigars, cigarettes and cigarette- or pipe-tobacco.

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The two most harmful components of tobacco smoke are nicotine and tar. At smoking, they get into the human organism where they deposit and absorb, exerting there their heavily harmful influence on health.

25. The main alkaloid of tobacco is nicotine, but in its leaves, it contains a series of other chemically related compounds. At smoking, about 30-60% of the nicotine content gets into the smoke, and 20-90% of this amount is absorbed in the human organism, depending on the mode of smoking, whether it occurs fast or

slowly, or whether the smoke is inhaled directly into the lungs. In spite of its harmful and toxic effect, the delight of smoking is provided by nicotine.

However, a more serious danger than nicotine is for human organism and for 5 human health the tar present in smoke, as it contains carcinogenic substances (e.g. benzpyrene). Passive smokers are subjected involuntarily to coexistence with tobacco smoke, thus smokers damage not only themselves, but also people living in their surrounding as well. Therefore solutions should be searched for a significant reduction of these dangers.

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Numerous smoke filters have been developed for reducing the amount of nicotine, and especially tar, present in cigarette smoke introduced into human organism. They may be filters containing additives (e.g. active carbon, charcoal), promoting ventilation or heating, or filters suitable for dispersing 15 smoke. Such are described e.g. in US patents No. 3,958,579; 3,882,877; 3,762,422; DE-OS 29 02 120 and DE-OS 23 56 569. Their common draw-back is that the air resistance is significantly increased by the filter and thus their smoking is rather difficult. Further on, they impair the aroma of the tobacco; the habitual character of the cigarette has changed. In this way, a cigarette with a 20 new nature and an impaired delight value was received from the traditional cigarette of known and enjoyed characteristics.

Last but not least, applying such amendments in an existing production technology is rather complicated and expensive due to the necessary change 25 of the whole machinery. Thus, these solutions would mean only a disadvantage for the tobacco industry.

The object of the present invention is to develop a filter unit which is applicable in cigarettes provided with filter-tip, the production of which can be fitted into

traditional production technology, in a way that the original nature of the cigarette, its smokability, aroma and delight value remain and, at the same time, the carcinogenic tar and nicotine content of the smoke is reduced significantly.

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Accordingly, the filter unit contains wood cuttings of particle sizes of 0.2 - 1.2 mm impregnated with sodium chloride, preferably with a solution of 20-40 % of sodium chloride and 80-60 % of water. The wood cuttings may be present loose, or alternatively, applied on a strip made of cellulose-acetate.

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It should be noted that the wood cuttings should preferably be in a loose form, as the cellulose-acetate strip has been proven to be carcinogenic, similarly to all other filter-tips with additional filters. At every puff, together with the smoke, some of the cellulose-acetate gets into the lung, and may cause lung cancer by 15 accumulating there.

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The filter unit according to this invention contains natural and harmless materials instead of the harmful and carcinogenic cellulose-acetate, in addition to its capacity for the significant reduction of the amount of carcinogenic tar and toxic and harmful nicotine.

The filter unit can be applied between the tobacco body and the filter tip, or between two parts of the filter tip, and can be separated from the filter by a closing web.

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Wood cuttings alone are capable of some filtering. However, they become an excellent adsorber upon impregnating them by sodium chloride. The big surface area of the impregnated wood cuttings becomes porous after drying,

due to the presence of sodium chloride crystals, further increasing thereby the original surface area.

Wood cuttings impregnated with sodium chloride solution as filter perform increased physical filtering of the cigarette smoke due to the increased crystalline and porous surface. It, the tar and nicotine content of the smoke can deposit on and adhere to an increased surface area when the cigarette smoke passes through.

10 On the other hand, the sodium chloride solution increases the filtering effect not only by increasing the surface area, but also by forming a crystallized film capable of dissolving and crystallizing again and again. The crystalline sodium chloride becomes a good adsorbent when it gets into contact with the hot and moistureous cigarette smoke, and its surface becomes activated by some 15 dissolution and softening. Then, the tar and nicotine particles adhere to its surface, then penetrate into the filtering medium. At the time the hot and moistureous smoke leaves the filter, the slightly heated sodium chloride cools down and crystallizes, adsorbing thereby the tar and nicotine therein. At every new puff the adsorption is repeated.

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In addition, the filter unit according to the invention directs the smoke passing through it to the whole surface area of the filter and distributes it on the surface uniformly. Thus, the whole surface area is utilized and the efficiency increases.

25 In traditional filters, filtering occurs only on part of the surface, since the air-smoke mixture swirls to the central part of the filter and the deposition and adsorption of tar and nicotine concentrates on this part.

The use of wood cuttings is advantageous as it is a waste material, it is cheap and it is a natural substance (which is important in view of environmental

protection). Its weight is also small: the weight of the filter unit made of it does not reach the weight of the charcoal filter applied on a cellulose-acetate tape used world-wide in filter cigarettes. It is a soft material, thus it can be fitted into every technology of cigarette and filter manufacture, and due to its polygonal 5 shape, it has a large surface area. Further on, its structure is fibrous and, owing to all this, it has a very high adsorption capacity.

The sodium chloride solution can be absorbed and it can impregnate the wood cuttings. After drying, the thin film forms a crystalline and porous surface, the 10 unevennesses of which increase the whole surface area, increasing thereby the filtering capacity. At contacting with the hot and moistureous air, the surface gets slightly dissolved and softened, and as a result, the microparticles of tar and nicotine adhere to the surface immediately. After cooling, the sodium chloride solution crystallizes, gets solid and porous again.

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By applying the filter unit according to the invention, the tar content of cigarette smoke can be reduced by 10-30%, whereas its nicotine content by 12-32%, depending on the nature and quality of the tobacco, on the length of the cigarette body, without influencing or changing the aroma, delight value and 20 character of the cigarette.

Further details of the invention will be explained by examples, with reference to the enclosed drawings.

25 **Figure 1** is the longitudinal section of a cigarette provided with a filter unit according to the invention;

**Figure 2** is the cross-section of a filter unit;

**Figure 3** is the cross-section of another embodiment of the filter unit;

**Figure 4** is the section of another embodiment of a cigarette provided with a filter unit according to the invention.

5 Figure 1 shows the longitudinal section of a filter-tip cigarette. Body 1 of the cigarette consists of tobacco 3 covered by cigarette paper 2, while filter tip 4 contains the traditional filtering element: a helically wound strip. Filter unit 5 according to the invention is arranged between body 1 and filter tip 4. They are separated by a web 6.

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Cross sections of the two embodiments of filter unit 5 are shown in Figures 2 and 3.

15 In the embodiment shown in Fig. 2, the structure of filter unit 5 is similar to that of filter tip 4. The wood cuttings 9 according to the invention are spread on the surface of a helically wound acetate strip 8 in paper covering 7.

20 In the embodiment shown in Fig. 3, wood cuttings 9 are arranged loose in paper covering 7. Their spillage is hindered in both cases by web 6 shown in Fig. 1.

25 The filter unit according to the invention can be arranged not only between the cigarette body 1 and the filter tip 4, but also within the filter tip 4. Figure 4 illustrates an embodiment in which filter tip 4 is separated into two parts, and the filter unit 5 according to the invention is inserted between these two parts. Between filter unit 5 the right part of filter tip 4 there is a web 6.

In the following, the invention will be explained more in details by examples.

In Tables 2-5, the tar and nicotine contents of a traditional filter-tip cigarette and those of cigarettes provided with the filter unit according to the invention will be compared. Tests have been performed on cigarettes according to Table 1. different embodiments of filter units according to the invention have been built into this cigarette, and the original cigarette has been used as control.

Characteristics of the original cigarette were the following:

**Table 1**

10	Full length of the cigarette	98.6 mm
	Body length	72.6 mm
	Filter length	26.0 mm
	Diameter of the cigarette	7.9 mm
	Total weight	1.1153 g
15	Tar content	0.5 mg
	Nicotine content	0.93 mg

The tests have been carried out by a routine analytical cigarette smoking machine according to the following standards:

- 20 - ISO 3308 (smoking)
- ISO 4387 (determination of the total and nicotine-free dry material by using routine analytical cigarette smoking machine)
- ISO 10 315 ( determination of the nicotine content in smoke condensates of cigarettes by gas chromatography)
- 25 - ISO 10362-2 (determination of water in smoke condensates of cigarettes by the Karl Fischer method).

In Table 2, results are shown for the embodiment containing the filter unit of cigarettes shown in Fig. 1, in which the impregnated wood cuttings were applied onto an acetate strip shown in Fig. 2. The wood cuttings have been 5 impregnated with a solution of 20% NaCl and 80% water.

**Table 2**

		Control	Invention
	Tar (mg/cigarette)	11.5	9.22
10	Nicotine (mg/cigarette)	0.93	0.79
	Tar reduction (%)		12.2
	Nicotine reduction (%)		15.12

Table 3 shows the results for samples made according to Fig. 1 as well, but the 15 wood cuttings in the filter unit were loose.

**Table 3**

		Control	Invention
	Tar (mg/cigarette)	10.5	9.0
20	Nicotine (mg/cigarette)	0.93	0.77
	Tar reduction (%)		14.28
	Nicotine reduction (%)		17.20

Samples in Table 4 were prepared according to the embodiment shown in Fig. 25 4; the filter unit consisted of acetate strip according to Fig. 2.

**Table 4**

		Control	Invention
Tar	(mg/cigarette)	10.5	9.34
Nicotine	(mg/cigarette)	0.93	0.80
5 Tar reduction (%)			11.10
Nicotine reduction (%)			14.02

Samples in Table 5 were prepared according to Fig. 4, the filter unit in them contained loose, impregnated wood cutting particles.

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**Table 5**

		Control	Invention
Tar	(mg/cigarette)	10.5	9.10
Nicotine	(mg/cigarette)	0.93	0.78
15 Tar reduction (%)			13.40
Nicotine reduction (%)			16.32

It is well seen from the Tables that the filter unit according to the invention reduces the tar and nicotine content of cigarette smoke in each case. At the 20 same time, the smoke distribution became more uniform and, as a consequence, the efficiency of the filter was increased.

In the case of cigarettes tested, the density (0.4 g/cm<sup>3</sup>) and weight (0.25 g) of the filter unit met the requirements applied in the known filter-tip manufacturing 25 technologies and were about the minimum values of density and weight allowed for the technology used for the tests, while the corresponding reduction

in tar and nicotine content was between 10 and 20 %. At the same time, the delight value of the cigarette and the air resistance of the filter did not increase with respect to the control samples.

- 5 According to the technology applied nowadays throughout the world, the density and weight of the filter unit according to the invention can be increased, thus the amount of tar and nicotine filtered out can also be increased. By increasing the compactness of the filter unit (which must not exceed the compactness of the tobacco chippings in the body), as well as by increasing
- 10 the size of the filter unit, the tar and nicotine content can be further decreased without changing the delight value of the cigarette or increasing the air resistance of the filter, i.e. the smokability of the cigarette was not deteriorated.

The embodiments shown in the examples illustrate the invention only, and the  
15 cigarettes can be prepared in numerous other versions within the scope  
claimed.